Reduced Access Characterization Subsystem

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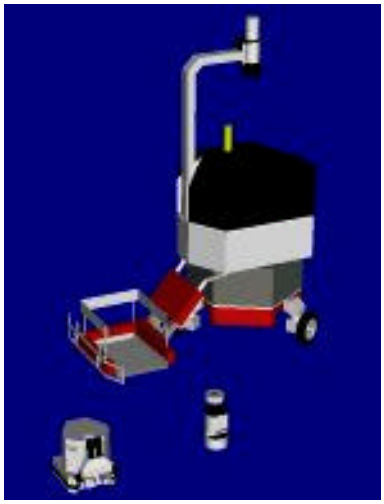
Participants
Idaho National Engineering and Environmental Laboratory
Oak Ridge National Laboratory
IS Robotics, Inc.

Technology Need
Many facilities exist in the Department of Energy (DOE) complex which are radiologically contaminated. These facilities include hot cells, glove boxes, fuel storage buildings, and process buildings. Ongoing characterization is being performed in these facilities by having a radiation control technician (RCT) manually monitor radiation levels with hand held instruments. These methods are effective for small or hard to reach areas, but large buildings such as the 300+ acre K-25 facilities located at Oak Ridge National Laboratory are better suited to automated floor characterization.

Research Objective
The research objective of the Reduced Access Characterization Subsystem (RACS) project was to develop a small floor characterization robot that could work cooperatively with the larger Mobile Automated Characterization System (MACS), a robot developed by two other DOE labs. The overall objective was to perform tedious, time consuming floor characterization automatically and provide superior radiological data collection and storage while reducing worker exposure.

Technology Description
RACS consists of the RACS robot and a homing/repeater beacon called TRACS (Transmitter for RACS). The RACS robot is approximately 14.5" x 11.0" x 12.0" and is capable of getting within 1" of a wall. RACS uses ultrasonic sensors for wall following and homing activities, infrared sensors and bump sensors for collision avoidance, and a radiation detector for gathering characterization data. A radio modem is carried on board RACS for communicating with TRACS and MACS. TRACS is used to coordinate communications between MACS and RACS, to improve radio communications when the MACS and RACS robots may be too far apart for single radio link, and to provide a homing beacon for RACS when characterization is complete.



In a typical characterization scenario, MACS would carry RACS around and deploy RACS to characterize areas that are too small, restricted, or congested for MACS. Upon deployment, MACS would transmit mission information and a map to RACS. RACS would then drop TRACS and perform its mission. Dead reckoning and sensor readings from the homing beacon are used to return the RACS robot to the point where MACS dropped off its teammate. RACS then picks up TRACS and waits until MACS returns, whereupon RACS gets back on the ramp.

Technology Status
The MACS platform was successfully modified to carry, deploy, and pickup the RACS platform in 1996. In a demonstration, RACS was carried on the MACS platform, deployed from MACS, surveyed a rectangular characterization area, and returned to MACS. Based on the original work with RACS, a second vehicle was built called RACS II. RACS II has additional sensors to enable improved wall following, dead reckoning, navigation, and radiation surveying. RACS II has demonstrated that several of the improvements, such as the wall following sensors, work quite well.

Research Opportunities
Much more research is waiting to be done with RACS. Cooperative robotics continues to be an area of interest and research, and is probably the way of the future for many industries. A lot of research is currently underway studying the use of relatively inexpensive cooperative robots for areas as diverse as land mine detection and disposal, military intelligence gathering, and agriculture.

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